WEATHER CONDITIONS AND CROP DISEASES IN TEXAS

By Frederick H. Blodgett

Agricultural and Mechanical College of Texas

The local environment under which plants grow is of interest to collectors and other students of plant life to a degree varying with the particular end in view, or group under observation. For the collector, local soil characters and gross moisture conditions usually serve sufficiently well to indicate the probable habitat in which specimens may be expected. More detail is desirable in the forms commonly regarded as more sensitive to substratum variations such as mosses and hepatics, but herbarium labels and field notes are usually inadequate even in these groups. That the distribution of so readily disseminated forms as parasitic fungi attacking field crops may also show response to environmental conditions of distinctly local character was shown by field observations here recorded.

Following the Gulf storm of August 16 to 20, 1915, in Texas, the damage to the cotton crop by the anthracnose (*Glomerella Gossypii* Edg.) was found to be directly related to the distributions of rainfall during the time the storm was passing over the affected area of the state. But in this case the relation of environment to disease was on a scale of great proportions and was in accordance with one's expectation, except as to degree of damage, which could not be anticipated. In 1916 there was no such great disturbance over the cotton area of the state and local factors were able to act more nearly as distinct elements of the environment. The season was rather dry than wet, though the drouth was not so severe as during the current season. The general condition of the cotton crop in Hill County in the central portion of the state (Texas) was approximately 80 per cent of normal, the drouth stunting the crop to the amount of 20 per cent, considering the general vigor of plants and yield of crop together. Five inspections of separate

fields were made near Hillsboro, at distances varying from one half mile to one and one half miles from the starting point; on the west of town, 8 per cent of the bolls were found to be spotted with anthracnose or bacterial spot (*Bacterium malvacearum* E. Sm.). In fields to the south, east and north of town successively the counts rose steadily until the last field inspected showed 26 per cent of the bolls (in scattered counts of 100 each) to be spotted. The air-line distance from the 8 per cent field to the 26 per cent one was perhaps three miles, the general character of the land was level, but somewhat broken by shallow erosion washes and depressions, irregularly distributed. It was found, however, that the local showers, though fewer than usual, commonly were more abundant and heavier in precipitation on the east and northeast of the town than elsewhere. The high percentages were in the area of the more frequent showers, *i. e.*, of greater local humidity. This factor was found active at other points also.

Not only is the areal distribution of local rainfall important, but the periodic recurrence of showers is of consequence also. Near Austin, in a field some five miles east of the city, a field was inspected on September 4, 1916, and gave a count of 10 spotted bolls to the 100. On the 23d the same field showed 28 per cent spotted. During the three weeks intervening, several showers had fallen, but apparently none so heavy as to give a half-inch precipitation and conditions were more or less cloudy. This favorable weather lasted for about one week with September 15 as the mean date for the period. The spots in this case were almost wholly due to anthracnose. The seasonal distribution of rainfall is especially important in the case of cotton anthracnose under Texas conditions, where first-class conditions may exist for several weeks in the picking season, only to become suddenly serious by the disturbance in weather conditions due to some tropical storm of more or less severity, as in August, 1915 (Galveston storm), and August, 1916 (Corpus Christi storm). In the eastern cotton states where the normal humidity is greater the degree of damage by these storms is probably less through change of humidity than by mechanical effect of wind and driven rain within the actual path of the storm. These factors are effective in Texas also, as a matter of course, but then further damage results from

the disturbed meteorological conditions resulting in continued showers or unsettled weather for some days or even several weeks after the storm has passed.

The dwarfing or stunting of the plants in the field, combined with the elevation of various parts of the same field as a factor influencing disease development, was indicated in a series of counts near Dallas. In a sandy soil a field of some 15 acres sloped from a small run upward to the boundary road, rising perhaps 20 or 25 feet in 100 yards. On the lower side, where moisture was best, and where damp morning air would tend to linger among the trees, the first count showed 8 per cent spotted bolls, mainly bacterial. At intervals of 2 or 3 rods other counts were made in passing to the higher ground. The plants became smaller as the drier parts of the field were approached, the most stunted plants being probably one third smaller than those along the low side of the field. In these plants the count showed 35 per cent of the bolls affected mainly by the bacterial infection. The greater exposure of the individual plants to wind-borne spores was evidently an important factor in the increased degree of spotting, as the spread of plants was reduced as well as their height, thus permitting free circulation of air and germ-laden dust among the plants.

In a field located in a damp spot near a creek, the plants were large enough to meet between the rows, and more than waist-high. Under usual rainfall such a field would be expected to show considerable anthracnose injury. At this time (same day as dry field count) only 5 per cent spotted bolls were found, nearly evenly distributed between the two spot diseases. This field was about three fourths mile from the preceding one reported.

Finally, the occurrence of weather conditions especially favorable for an epidemic development of an infrequent disease may be responsible for serious injuries to specific crops. In the Rio Grande Valley region of Texas, in Hidalgo County, a considerable area is devoted to cotton grown under irrigation. In June of this year many of the fields suddenly showed a marked yellow color of the leaves. Specimens sent to the Experiment Station were identified as *Aecidium Gossypii* (Science II. **46**: 268. 14 S 1917). The affected fields were visited by the writer in July and the aecidial irruptions found to be generally past activity and

commonly invaded by the rust-parasite *Tuberculina* in so far as the leaves still attached to the plants were concerned. These were, however, far fewer in number than those affected earlier, as shown by the dry leaves under the plants in the rows, which were shed by the plants before becoming parasitized.

The disease was noted almost simultaneously by Dr. Morton of Mercedes and County Agent Miller of Edinburg, from both of whom specimens were sent to the Experiment Station. Field inspections and interviews four weeks later showed the epidemic to be past, and no fresh areas developing. It was learned that about two weeks previous to the observed outbreak of the disease about a week of showers and cloudy weather had occurred, this being distinctly unusual in that section. After making allowance for possible inaccuracy of statement, it seems probable that the disease was present in cotton fields on the Mexican side of the Rio Grande, as Dr. Morton learned of "yellow leaves" occurring in that locality. Southwest winds prevail during much of the season in that part of Texas, and invasion of spores from the alternate host (as yet unknown) or possibly viable sporidia from germinating teleutospores might be carried over the half mile of river between the Mexican and American fields. According to Dr. Morton, the trouble spread northeasterly from Rio Grande City or Sam Fordyce to Edinburg and Donna, making a total travel of 25 or 30 miles in a couple of weeks or less, according to his observations and conversations with farmers.

An interesting ecological detail was learned during a personal inspection of the fields, namely, that those fields suffered most which were nearly ready to show first blooms. Fields either older or younger were less seriously injured. This was shown in the fields showing effects of serious damage by the presence of bolls with the involucral bract and calyx carrying aecidial sori; fallen leaves with the rust areas in abundance were numerous under such plants.

There may be some close relation between the date of application of irrigation water to the field and the appearance therein of the rust. This point did not come to mind in time to receive attention while in the field, but may have an important bearing through the use of the Rio Grande water as a vehicle of transport

of debris of vegetation in which the telial phase of the rust might have been distributed. This possibility would help to explain the uniformity in degrees of infection existing over entire field, as though irrigation water had been in some way related to the epidemic, as well as the age of the crop plants.

About a week after my visit, Dr. E. W. Olive examined the affected area and confirmed the above details from his observations and interviews. In addition he learned from one or two of the more observing farmers that the aecidial sori had been seen scatteringly as early as late April of this year, and apparently the same trouble noticed, though doing no essential damage in other years. This would indicate that the aecidial stage (and by inference the other stages of the rust) has been present for some time as a parasite too insignificant as to damage to come to notice as a "disease" until the special conditions of weather and crop development made the outburst this season possible, as an epidemic. This would appear to be confirmed by the abundance of infections of the aecidial sori by the secondary parasite *Tuberculina*, which at that season would hardly find other hosts (rust) in abundance (sunflower, cocklebur and Bermuda-grass leaves with rust pustules appeared to be free from the *Tuberculina*).

The sudden cessation of fresh infection with the passing of favorable weather conditions is in keeping with similar sensitiveness among other rust species, and is one of the natural checks to the spread of such parasites.

The above examples indicate the intimate relation that evidently exists between the healthy development of crop plants and the injuries caused by invasion of parasitic fungi producing disease conditions. The influence of climatological changes over considerable areas or during a number of days or weeks has been recognized for a long time, but the direct relation of small variations in limited areas has been less evident. In connection with diseases conveyed from season to season in planting seed (*e. g.*, bean anthracnose, cotton anthracnose), the saving of such seed from areas of lightest local rainfall, and during the most favorable period for seed-ripening becomes a practice of demonstrable value based on "crop hygiene."